

CLAIMS

What is claimed is:

1. A method of making an electronics module, where said electronics module is to operate at one of a predetermined plurality of operating speeds, said method comprising:
 - providing a plurality of integrated circuits;
 - assembling said electronics module by demountably attaching selected ones of said plurality of integrated circuits to a module substrate;
 - testing said demountably assembled module at one of said plurality of operating speeds;
 - if said module fails said testing:
 - removing at least one of said integrated circuits determined to have caused said failure from said module substrate,
 - replacing said at least one removed integrated circuit with another of said plurality of integrated circuits, and
 - repeating said testing step and, if said module again fails said testing, said removing, replacing, and repeating steps.
2. The method of claim 1, wherein:
 - each integrated circuit includes a plurality of input/output terminals and a plurality of conductive elongate interconnection elements attached to said input/output terminals, and
 - said module substrate includes a plurality of contact locations for contacting said elongate interconnection elements.
3. The method of claim 2, wherein said step of assembling said module comprises:
 - bringing elongate interconnection elements attached to said selected integrated circuits into contact with corresponding ones of said contact locations, and
 - demountably securing said selected integrated circuits to said module substrate.

4. The method of claim 3, wherein said step of demountably securing comprises applying a temporary force to said selected integrated circuits in a general direction of said module substrate.
5. The method of claim 4, wherein said step of removing said at least one integrated circuit comprises:
 - removing said temporary force from said at least one integrated circuit, and
 - moving said at least one integrated circuit away from said module substrate.
6. The method of claim 3, wherein said step of demountably securing comprises clipping said selected integrated circuits to said module substrate.
7. The method of claim 6, wherein said step of removing said at least one integrated circuit comprises:
 - unclipping said at least one integrated circuit, and
 - moving said at least one integrated circuit away from said module substrate.
8. The method of claim 3, wherein said step of demountably securing comprises wedging elongate interconnection elements attached to said selected integrated circuits in corresponding ones of said contact locations
9. The method of claim 8, wherein said step of removing said at least one integrated circuit comprises removing said elongate interconnection elements attached to said at least one integrated circuit from corresponding ones of said contact locations.
10. The method of claim 2, wherein said conductive elongate interconnection elements comprise spring contacts.
11. The method of claim 2, wherein said contact locations are selected from a group consisting of recesses, pads, terminals, holes, and vias.

12. The method of claim 1 further comprising:
if said module passes said testing, permanently securing to said module substrate said integrated circuits demountably secured to said module substrate.
13. The method of claim 12, wherein said step of permanently securing comprises soldering said elongate interconnection elements secured to said integrated circuits to corresponding ones of said contact locations.
14. The method of claim 12, wherein said step of permanently securing comprises applying an adhesive to adhere said integrated circuits to said module substrate.
15. The method of claim 1, wherein said step of assembling said module comprises selecting ones of said plurality of integrated circuits without regard to a speed rating of said integrated circuits.
16. The method of claim 1 further comprising:
testing each of said plurality of integrated circuits to determine a maximum operating speed of said integrated circuit; and
grouping said plurality of integrated circuits in accordance with said maximum operating speeds of said integrated circuits.
17. The method of claim 16, wherein said step of assembling said module comprises:
selecting integrated circuits from a group corresponding to a desired operating speed of said module.
18. The method of claim 1, wherein:
each of said integrated circuits includes a plurality of input/output terminals, and
said module substrate includes a plurality of elongate interconnection elements for contacting corresponding ones of said input/output terminals.

19. The method of claim 1, wherein said assembling said electronics module comprises utilizing at least one die edge registration fixture formed on said module substrate to demountably attach said selected integrated circuits to said module substrate.
20. The method of claim 1, wherein said assembling said electronics module comprises utilizing a robotic work cell to demountably attach said selected integrated circuits to said module substrate.
21. The method of claim 1 further comprising:
if said module passes said testing:
removing said integrated circuits from said module substrate, and
permanently securing said integrated circuits to a second module substrate.
22. A method of making an electronics module, where said electronics module is to operate at one of a predetermined plurality of operating speeds, said method comprising:
grouping a plurality of integrated circuits in accordance with said operating speeds;
selecting integrated circuits from one of said groups;
assembling said electronics module by demountably attaching said selected integrated circuits to a module substrate;
testing said demountably assembled module at an operating speed corresponding to said one of said groups:
if said module fails said testing:
removing at least one of said integrated circuits determined to have caused said failure from said module substrate,
replacing said at least one removed integrated circuit with another of said plurality of integrated circuits selected from said one of said groups, and
repeating said testing step and, if said module again fails said testing, said removing, replacing, and repeating steps.

23. The method of claim 22, wherein said step of grouping a plurality of integrated circuits in accordance with said operating speeds comprises:
- determining an actual operating speed of each said integrated circuit; and
 - grouping said integrated circuits in accordance with said actual operating speeds.
24. The method of claim 22, wherein said step of grouping a plurality of integrated circuits in accordance with said operating speeds comprises:
- determining an actual operating speed of each said integrated circuit;
 - subtracting a guard band from said actual operating speed to obtain a guard-banded operating speed; and
 - grouping said integrated circuits in accordance with said guard-banded operating speeds.
25. The method of claim 22, wherein:
- each integrated circuit includes a plurality of input/output terminals and a plurality of conductive elongate interconnection elements attached to said input/output terminals, and
 - said module substrate includes a plurality of contact locations for contacting said elongate interconnection elements.
26. The method of claim 25, wherein said step of assembling said module comprises:
- bringing elongate interconnection elements attached to said selected integrated circuits into contact with corresponding ones of said contact locations, and
 - demountably securing said selected integrated circuits to said module substrate.
27. The method of claim 26, wherein said step of demountably securing comprises applying a temporary force to said selected integrated circuits in a general direction of said module substrate.
28. The method of claim 27, wherein said step of removing said at least one integrated circuit comprises:

removing said temporary force from said at least one integrated circuit, and
moving said at least one integrated circuit away from said module substrate.

29. The method of claim 26, wherein said step of demountably securing comprises
clipping said selected integrated circuits to said module substrate.

30. The method of claim 29, wherein said step of removing said at least one integrated
circuit comprises:

unclipping said at least one integrated circuit, and
moving said at least one integrated circuit away from said module substrate.

31. The method of claim 26, wherein said step of demountably securing comprises
wedging elongate interconnection elements attached to said selected integrated circuits in
corresponding ones of said contact locations

32. The method of claim 31, wherein said step of removing said at least one integrated
circuit comprises removing said elongate interconnection elements attached to said at least
one integrated circuit from corresponding ones of said contact locations.

33. The method of claim 25, wherein said conductive elongate interconnection elements
comprise spring contacts.

34. The method of claim 25, wherein said contact locations are selected from a group
consisting of recesses, terminals, pads, holes, and vias.

35. The method of claim 22 further comprising:
if said module passes said testing, permanently securing to said module substrate said
integrated circuits demountably secured to said module substrate.

36. The method of claim 35, wherein said step of permanently securing comprises soldering said elongate interconnection elements attached to said integrated circuits to corresponding ones of said contact locations.
37. The method of claim 35, wherein said step of permanently securing comprises applying an adhesive to adhere said integrated circuits to said module substrate.
38. The method of claim 22, wherein said assembling said electronics module comprises utilizing at least one die edge registration fixture formed on said module substrate to demountably attach said selected integrated circuits to said module substrate.
39. The method of claim 22, wherein said assembling said electronics module comprises utilizing a robotic work cell to demountably attach said elected integrated circuits to said module substrate.
40. The method of claim 22 further comprising:
if said module passes said testing:
removing said integrated circuits from said module substrate, and
permanently securing said integrated circuits to a second module substrate.

41. A method of making an electronics module, where said electronics module is to operate at one of a predetermined plurality of operating speeds, said method comprising:

- providing a plurality of integrated circuits;
- testing each said integrated circuit to determine a maximum of said operating speeds at which said integrated circuit is capable of operating;
- sorting said integrated circuits into groups in accordance with said operating speeds;
- determining which of said groups includes sufficient integrated circuits for at least one electronics module;
- selecting one of said determined groups;
- assembling an electronics module by demountably attaching integrated circuits from said selected group to a module substrate;
- testing said demountably assembled module at an operating speed corresponding to said selected group;
- if said module fails said testing:
 - removing at least one of said integrated circuits determined to have caused said failure from said module substrate,
 - replacing said at least one removed integrated circuit with another integrated circuit from said selected group, and
 - repeating said testing step and, if said module again fails said testing, said removing, replacing, and repeating steps.

42. The method of claim 41, wherein said step of selecting one of said determined groups comprises selecting a group that corresponds to a highest operating speed of said groups determined at said step of determining which of said groups includes sufficient integrated circuits for at least one electronics module.

43. The method of claim 41, wherein each of said operating speeds is assigned a priority, and said step of selecting one of said determined groups comprises: selecting a group that corresponds to a highest of said assigned priorities among said groups determined at said step of determining which of said groups includes sufficient integrated circuits for at least one electronics module.

44. A method of making an electronics module, where said electronics module is to operate at one of a predetermined plurality of operating speeds, said method comprising:

- (a) providing a plurality of integrated circuits;
- (b) assembling an electronics module by demountably attaching selected ones of said integrated circuits to a module substrate;
- (c) testing said module to determine a maximum of said operating speeds for each of said selected integrated circuits;
- (d) identifying which of said plurality of operating speeds corresponds to a majority of said selected integrated circuits;
- (e) removing ones of said selected integrated circuits from said module board whose maximum operating speed does not correspond to said identified operating speed, and sorting said removed integrated circuits into speed groups corresponding to said plurality of operating speeds;
- (f) replacing said removed integrated circuits;
- (g) testing said module at said identified operating speed;
if said module fails said testing:
 - (h) removing at least one of said integrated circuits determined to have caused said failure from said module substrate,
 - (i) replacing said at least one removed integrated circuit with another integrated circuit, and
 - (j) repeating said testing step and, if said module again fails said testing, said removing, replacing, and repeating steps.

45. The method of claim 44 further comprising assembling a new electronics module by:

if at least one of said speed groups includes enough integrated circuits for at least one module, selecting integrated circuits from one of said at least one of said speed groups and demountably attaching said selected integrated circuits from said speed group to a module substrate;

if none of said speed groups includes sufficient integrated circuits for at least one module, repeating said steps (b), (c), (d), (e), and (f).

46. The method of claim 45 further comprising testing said new electronics module.